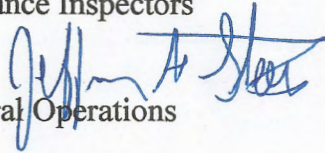


COMMONWEALTH OF VIRGINIA
Department of Environmental Quality

Subject: Land Protection and Revitalization Guidance Memo No. LPR-SW-2020-01:
Managing Leachate in Compliance with the VSWMR

To: Regional Land Protection Program Managers, Solid Waste Permit Writers, Solid Waste Compliance Inspectors

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Director, Central Operations



Through: Leslie Beckwith
Director, Office of Financial Responsibility and Waste Programs

Date: July 16, 2020

Copies: Regional Directors, Deputy Regional Directors

Summary: DEQ assembled an internal Leachate Workgroup to examine recurring leachate issues at solid waste landfills discovered by compliance staff in the field. The workgroup developed this guidance after evaluation of current agency guidance, regulations, and practices to provide a consistent framework for compliance and consistency amongst regional offices.

Electronic Copy: Once effective, an electronic copy of this guidance will be available on the Virginia Regulatory Town Hall under the Department of Environmental Quality at <http://www.townhall.virginia.gov/L/gdocs.cfm?agencynumber=440>.

Contact Information: Please contact Kathryn Perszyk, Solid Waste Permit Coordinator at 703-583-3856 or Kathryn.Perszyk@deq.virginia.gov with any questions regarding the application of this guidance.

Certification: As required by Subsection B of [§ 2.2-4002.1](#) of the APA, the agency certifies that this guidance document conforms to the definition of a guidance document in [§ 2.2-4101](#) of the Code of Virginia.

Disclaimer: *This document is provided as guidance and, as such, sets forth standard operating procedures for the agency. However, it does not mandate or prohibit any particular action not otherwise required or prohibited by law or regulation. If alternative proposals are made, such proposals will be reviewed and accepted or denied based on their technical adequacy and compliance with appropriate laws and regulations.*



Managing Leachate in Compliance with the VSWMR

I. Introduction

Leachate is defined in the Virginia Solid Waste Management Regulations (VSWMR, 9 VAC 20-81) as the liquid that has *passed through or emerged from* solid waste. Leachate is generated from liquids present in the waste disposed, precipitation (rain, snow, etc.) that percolates through the waste, and waste decomposition. Leachate can also be generated from unlined landfills where historical waste disposal interacts with the groundwater table. The quantity of leachate generated and the concentration of soluble, suspended, or miscible materials from the waste disposed contained in the leachate vary depending on site-specific factors such as:

- types of waste disposed,
- age of the buried waste, and
- operational practices such as
 - size of the working face;
 - area of landfill that is inactive but not yet closed;
 - cover materials used and frequency of application; and
 - design of landfill final cover installed.

Solid waste disposal facilities are required to have a Leachate Management Plan (or the details of such plan included in the facility's Design Report) in accordance with 9 VAC 20-81-210 addressing the leachate management system to be installed and operated at the landfill. This plan shall include numerical estimates of leachate to be generated, design of the leachate collection and removal system installed in conjunction with the bottom liner system; conveyance and storage features to manage leachate prior to disposal; approved disposal methods; and information regarding any leachate management or treatment, such as recirculation or evaporation.

In addition, the landfill operational performance standards found at 9 VAC 20-81-140.A.6., dictate that landfills shall not allow leachate from the landfill to drain or discharge into surface waters except when treated onsite and discharged into surface water as authorized under a Virginia Pollutant Discharge Elimination System (VPDES) Permit ([9VAC25-31](#)). In accordance with 9 VAC 20-81-210.F., the facility is required to immediately repair any leachate seeps discovered during normal operations or routine self-inspections in order to avoid such leachate discharges to surface waters.

This guidance was developed to clarify that landfills shall operate within the design requirements of 9 VAC 20-81-210, and establish a framework for compliance assessments related to leachate management activities to ensure regional consistency.

II. Background

Submission Instructions for Solid Waste Management Facilities, including a submission instruction outlining requirements for landfill design were initially issued June 1, 1993, and subsequently revised April 23, 2002, and February 1, 2012, to update for statutory and regulatory changes. The

February 2012 revision added a stand-alone submission instruction titled “Leachate Management Plans for Solid Waste Management Facilities” as Submission Instruction No. 7 in lieu of having facilities address leachate management system design elements in the Design Report required by 9 VAC 20-81-470.B.

In response to leachate issues observed, including leachate head on the liner, lack of surge capacity in surface impoundments, and management of leachate seeps, the Department assembled an internal Leachate Workgroup in August 2017 to examine leachate issues from an overall perspective. Group tasks included an evaluation of current agency guidance, interpretations, regulations and practices and development of a framework for compliance and consistency among regional offices. The guidance that follows was developed by the workgroup.

III. Authority

This document provides guidance to implement the VSWMR related to DEQ solid waste permitting and compliance of leachate management activities at solid waste disposal facilities. The authority for promulgation of these regulations and development of this guidance is contained in [§10.1-1402](#) of the Code of Virginia.

IV. Definitions

The definitions in [§10.1-1400](#) of the Code of Virginia and [9 VAC 20-81-10](#) of the VSWMR apply to the implementation of these procedures. Additional definitions specific to this guidance, including those borrowed from the Virginia Pollutant Discharge Elimination System (VPDES) regulation applicable to the Landfill Sector ([9 VAC 25-151-190](#)) are provided below.

“Cap drainage” consists of precipitation that percolates through cover soils on an engineered cap and drains prior to entering the waste, emerging at the base of a slope or mid-slope drain on a closed or partially closed landfill area. Cap drainage is a form of runoff.

“CIR” means compliance inspection report.

“Contaminated stormwater” means stormwater that comes in direct contact with landfill wastes, the waste handling and treatment areas, or landfill wastewater. Some areas of a landfill that may produce contaminated stormwater include, but are not limited to, the working face of an active landfill; the areas around wastewater treatment operations; trucks, equipment, or machinery that has been in direct contact with the waste; and waste dumping areas. (9 VAC 25-151-190)

“Discharge of pollutant” means a pollutant discharge to *surface water* as defined in 9 VAC 25-31-10. (*Solid waste is considered a pollutant.*)

“Gas condensate” means the liquid generated as a result of gas control or recovery processes at the solid waste management facility. (9 VAC 20-81-10)

“Landfill wastewater” as defined in 40 CFR Part 445 (Landfills Point Source Category) means all wastewater associated with, or produced by, landfilling activities except for sanitary wastewater, noncontaminated stormwater, contaminated groundwater, and wastewater from recovery pumping wells. Landfill wastewater includes, but is not limited to, leachate, gas collection condensate,

drained free liquids, laboratory derived wastewater, contaminated stormwater and contact washwater from washing truck, equipment, and railcar exteriors and surface areas that have come in direct contact with solid waste at the landfill facility. (9 VAC 25-151-190)

“Leachate” means a liquid that has *passed through or emerged from* solid waste and contains soluble, suspended, or miscible materials from such waste. Leachate and any material with which it is mixed is solid waste; except that leachate that is pumped from a collection tank for transportation to disposal in an offsite facility is regulated as septage, leachate discharged into a waste water collection system is regulated as industrial waste water and leachate that has contaminated groundwater is regulated as contaminated groundwater. (9 VAC 20-81-10)

“Leachate head” means the depth or height of leachate accumulated on the impervious layer beneath the landfill (i.e. geomembrane, engineered clay, other bottom liner, or natural aquitard). Leachate head, as discussed in guidance [Section V.A.](#), does not account for the depth of leachate in manifold trenches and sumps.

“Leachate seep” means a flow or leak of leachate through landfill cover materials, often occurring on side slopes. Leachate seeps do not include cap drainage or gas condensate.

“POTW” means a publicly or privately owned treatment works, also referred to as a wastewater treatment plant or WWTP. Options for management of collected leachate in accordance with 9 VAC 20-81-210.D. include direct discharge to a POTW or transportation to a permitted WWTP.

“Runoff” means any rainwater, leachate, or other liquid that drains over land from any part of a solid waste management facility. (9 VAC 20-81-10) *Runoff from the active portion of the landfill unit must not cause a discharge of pollutants to State waters, except in accordance with the requirements of a VPDES permit.*

“Stormwater” means stormwater runoff, snow melt runoff, and surface runoff and drainage (9 VAC 25-151-10).

“Surface water” means all state waters that are not groundwater as defined in [§62.1-255](#) of the Code of Virginia and includes all natural water bodies, tributaries, and wetlands, as defined in 9 VAC 25-31-10. Waste treatment systems, including treatment ponds and lagoons designed to meet the requirements of the Clean Water Act and the law, are not surface waters according to 9 VAC 25-31-10. *Stormwater becomes surface water when it enters a receiving stream.*

“VPDES” means Virginia Pollutant Discharge Elimination System.

“VSWMR” means Virginia Solid Waste Management Regulations.

V. Guidance

This guidance provides a framework for compliance and consistency among regional offices specifically addressing leachate issues as discussed herein. This guidance is in addition to the [Solid Waste Inspection Manual \(SWIM\)](#), which provides procedural guidance for performing inspections

of permitted solid waste management facilities. This guidance also uses terms as defined in the SWIM. Specifically, Chapter 5 of the SWIM defines severity levels (I, II, and III), describes how those severity levels are used to classify noncompliance, and provides guidance on how to select the most appropriate compliance instrument (Deficiency Letter, Warning Letter, or Notice of Violation) based on the alleged violations observed. Selection of a compliance instrument should consider the number, frequency, and severity level of each alleged violation identified. The SWIM further details additional considerations for selecting the most appropriate non-compliance instrument, including but not limited to:

- probability of exposure to waste or waste constituents;
- potential consequences of exposure or a release;
- effect of the violation on the statutory or regulatory program;
- extent of deviation from the requirement; and
- whether or not there has been a violation of requirements enforced by another regulatory program (e.g. Air, Water, or Petroleum).

These factors are taken into account to help identify the significance of the noncompliance observed so that a prioritized response can be initiated to resolve the matter and facilitate return to compliance. This guidance provides considerations specific to leachate issues in accordance with the SWIM guidelines.

A. Leachate Head on Liner

In accordance with 9 VAC 20-81-210.A.2., landfill operators are required to maintain and operate leachate collection systems that are designed and constructed to maintain less than 30cm (12in) depth of leachate over the liner. Some landfills have equipment such as submersible leachate level transmitters or transducers that allow for accurate, quantitative, and automatic measurement of leachate depth over the liner. Other landfills (e.g. gravity-fed systems) may estimate leachate head over the liner based on the geometry of the bottom liner and liquid levels measured in the sump or a side-slope riser and are still able to recognize when leachate is accumulating in excess of 30 cm. This guidance is not intended to require a retrofit to gravity-fed leachate collection systems.

Regardless of the design of the leachate collection system, routine preventative maintenance is key to proper leachate management, and a failure to maintain the collection system or its components (e.g. lines, pumps or gravity flow controls, gaskets, bearings, impeller, valves, control panel, etc.) could cause leachate to accumulate on the liner in excess of the regulatory limit. This may result in possible landfill stability issues, leachate seeps, overflows or groundwater contamination from leachate leaking through the bottom liner and underlying subsoils.

In accordance with 9 VAC 20-81-485, the facility's Operations Manual should contain detailed instructions to the site operator regarding all aspects of site operation in order to ensure that the operational requirements of the VSWMR are achieved, including proper leachate management. The Operations Manual should identify monitoring, maintenance, backup equipment, types of records maintained, and other site-specific instructions for maintaining the leachate collection system, including but not limited to the:

- Schedule and frequency for inspecting and servicing pumps and associated equipment (motors, gaskets, bearings, impellers, alarms, flow meters, control panel, etc.);

- Schedule and frequency for cleaning out leachate lines as needed to maintain proper functionality of the system;
- Methods for documenting equipment maintenance (such as leachate line clean-outs);
- Methods for monitoring (i.e. estimating or measuring) and recording leachate head over the liner and leachate head exceedances;
- Instructions for leachate operations in advance of a storm event; and
- Frequency and method for recording leachate volumes generated and disposed (pump or flow meter readings, etc.).

Operators must be familiar with how their leachate collection system control panel works and how to interpret flow meter, pump, and other dashboard readings.

For example, landfills typically monitor and document leachate flow rates, and a decreased pumping rate may indicate that maintenance is required. Due to the corrosive environment in the leachate collection system, pumps and other system components need to be serviced periodically (e.g. annually) to repair or replace parts, such as impellers, bearings or gaskets, and this may require removing the part and sending it offsite to the manufacturer or another company for maintenance. Leachate collection systems should ideally employ both a primary and a backup pump so that one pump can be used to transfer leachate while the other pump is being serviced. In addition to servicing the pumps, leachate collection lines should be back flushed, water jetted, or chemically cleaned to remove biological scum and sediment buildup that could block the lines, on an as-needed basis as supported by site-specific indicators. A blockage could cause leachate to accumulate upstream and be released through a manhole or seep out of the waste cell. Alarms are often used to alert landfill staff (through audible tones, visual lights, automatic phone call, text, and/or email) that leachate has risen to levels within wet wells or sumps higher than normal to maintain a leachate head at or below 30cm (12in) on the liner. If leachate levels rise high enough within the waste mass, slope failure could occur. Bulging, cracks, or a washboard effect have been observed to precede slope failure. Leachate storage units should also be pumped down in advance of a storm event to ensure there is adequate freeboard within the leachate lagoon or tank to be able to handle increased leachate generation caused by increased stormwater infiltration.

1. Compliance Considerations:

A single instance of leachate head greater than 30cm (12in) above the liner may or may not be cited as an alleged violation, depending upon the cause of the exceedance, the facility's timely response, and the risk to human health and the environment. Compliance inspectors should take into account:

- Facility reporting within the required timeframe (see SWIM Attachment 12);
- Reasons for leachate head exceedance, such as:
 - Failure to maintain or operate leachate system as designed,
 - Equipment failure,
 - Single or consecutive storm events with a rainfall total greater than that of a 24-hour, 25-year storm for the facility's location, or
 - Other emergency;
- Facility response and length of time to return to compliance;
- Potential or actual discharges to surface water, groundwater, wells, springs, or drinking water sources, or other releases;

- Depth of leachate over liner and elevation of accumulated leachate (i.e. above or below grade; relation to liner berm);
- Proximity to surface water, groundwater, wells, springs, or drinking water sources;
- Geologic conditions (e.g. karst topography);
- Effects on slope stability (as indicated by bulging, cracking, washboard effect, or other); and
- Repeated and/or continuing occurrence.

Note: The compliance assessment criteria in Section V.A.2. below, does not take into account when leachate head exceedances are caused by single or consecutive storm events resulting in a rainfall total **greater** than that of a 24-hour, 25-year storm for the facility's location. When the rainfall total exceeds that which corresponds to a 24-hour, 25-year storm, compliance staff should take that into consideration, along with all other information, to assess whether an alleged violation is still warranted and if the severity level of non-compliance should be adjusted.

The important factor is that the facility takes immediate measures to draw down the leachate head to protect public health and safety (e.g. prevent landfill instability due to high liquid levels, avoid releases to surface water, groundwater, wells, springs, or drinking water sources, and minimize potential for seeps, etc.). In addition to increasing pumping capacity and/or sending leachate to other disposal facilities, the facility should take additional operational measures to ensure the condition does not return (e.g. repair/replace equipment; clean out leachate lines; improve daily, progressive, or intermediate cover; install final cover; repair cracks or erosion to minimize stormwater infiltration; etc.).

2. **Classifying Alleged Non-Compliance:**

If observations, reports or records indicate leachate levels are greater than 30cm (12in) depth over the liner, the following criteria can be used to determine whether an alleged violation should be issued and the severity level of the alleged violation. An assessment of severity level should consider the risk to human health or the environment and the extent of deviation from the applicable requirements in the statute, regulations, and permit.

General Comment

- Facility reports within 24 hrs/5 days (unless alternate time is specified in the permit) and **can demonstrate and return level to below 12in within 7 days**, AND
- No discharges of leachate to stormwater channels, sediment basins, surface water, wells, or other water sources, AND
- Exceedance is NOT a result of failure to maintain or operate system as designed.

Some examples include (1) the facility is performing scheduled maintenance that results in *temporary* increased leachate levels while pumps are down; (2) single or consecutive storm events that *temporarily* overwhelm the system; and (3) electrical or other issues cause primary or backup equipment to go down *temporarily*.

Severity Level I Alleged Violation

- Facility reports within 24 hrs/5 days (or alternate time specified in the permit) and **can demonstrate and return level to below 12in within 15 days**, AND
- Facility has low levels (less than 20 in) of leachate head on liner or small leachate release that is contained immediately but no potential or actual discharge to surface water, wells, or other water sources, AND
- Exceedance is NOT a result of failure to maintain or operate system as designed, AND
- Issue was not documented as an alleged violation during the previous inspection.

Severity Level II Alleged Violation

- Facility reports within 24 hrs/5 days (or alternate time specified in the permit) and **can demonstrate and return level to below 12in within 45 days**, OR
- Exceedance not reported to DEQ as required, OR
- Facility has moderate levels (20 to 30 in) of leachate head on liner or release to stormwater management system and/or potential for discharge to surface water, but NO discharge to surface water, wells, or other water sources, OR
- Exceedance is result of failure to maintain or operate system as designed, OR
- Issue previously documented in Deficiency Letter and unaddressed.

Severity Level III Alleged Violation

- Facility reports within 24 hrs/5 days (or alternate time specified in the permit) but **is not able to demonstrate and return level to below 12in within 45 days**, OR
- Exceedance caused discharge to surface water, wells, or other water sources, OR
- Facility has significant levels (over 30 in) of leachate head on liner and exceedance is result of failure to maintain or operate system as designed, OR
- Major slope or high wall failure has occurred, OR
- Issue previously documented as Warning Letter and unaddressed.

B. Leachate Seeps

Leachate seeps result when the moisture in a waste mass finds a preferential flow path that directs leachate to the side slope of a landfill rather than down to the leachate collection system. Leachate seeps tend to occur when one or more of these conditions exist:

- Excess moisture in waste caused by wet-weather conditions such as rain, snow, freeze, or thaw;
- Impermeable layers in the landfill (e.g., daily or intermediate soil cover, former haul roads, etc.);
- Large impervious objects such as sheets of plastic or certain industrial wastes;
- Lack of proper daily/intermediate/progressive cover, large working face, or use of higher permeability cover materials like sandy soils;
- Erosion of cover; and
- Excessive leachate recirculation and water imbalance.

As defined in this guidance, leachate seeps are not cap drainage or landfill gas condensate. To distinguish between cap drainage and a possible leachate seep, consult the closure construction drawings to confirm the extent of the final cover system and presence of engineered cap drainage

features. Additionally, the area in question should be visually investigated to ensure the release does not show signs of leachate (discoloration, odor, etc.) which could seep from the area if there is damage to the geomembrane or soil cap. Care must be taken during this investigation to avoid inadvertent damage to the cap during the investigation. If uncertain, indicator tests, as discussed in [Subsection B.6.](#) below can be used to distinguish between leachate and other drainage unaffected by the waste unit.

Gas condensate is typically a discolored liquid with an odor that if leaking from a cracked or broken pipe in the gas collection system may appear to be a leachate seep. To distinguish between a gas condensate leak and a possible leachate seep, consult the landfill gas management plan drawings to confirm the location of landfill gas collection pipes which may be buried under cover soils. It is important to distinguish between a leachate seep and gas condensate leak so that the proper repairs can be made to the gas collection system instead of attempting conventional leachate seep repairs. While gas condensate is not considered leachate, it is a solid waste and must be collected, managed, and disposed of in accordance with the VSWMR or recirculated or drained by gravity into the landfill in accordance 9 VAC 20-81-200.C.3.c.

Runoff from the working face of a landfill is considered “contaminated stormwater,” not leachate. Generally, precipitation on the working face of a landfill (MSW, and most CDD and Industrial) will be contained and infiltrate to the leachate collection system. Any stormwater that runs off the working face and does not enter the leachate collection system should be managed as contaminated stormwater and is subject to effluent limitations under the VPDES permit. Alternatively, the owner may choose to direct or pump any runoff to their leachate collection system for treatment. Runoff from all other areas of the landfill will also be subject to limitations or monitoring and special conditions under the VPDES permit.

The facility is required to repair leachate seeps in accordance with 9 VAC 20-81-210.F. and

1. Take immediate steps to protect public health and safety;
2. Take immediate action to minimize, control, or eliminate the seep and properly contain and manage leachate at the source of the seep; and
3. Properly collect and dispose of any leachate released outside the disposal unit boundary.

The following subsections address the Department’s expectations with regards to these requirements and provide a framework for classifying alleged non-compliance and selecting the appropriate compliance instrument to accompany the compliance inspection report (CIR).

1. Permittee Responsibilities

Facility staff are required to regularly *inspect* the landfill cover systems for the presence of leachate seeps, especially after a storm event (9 VAC 20-81-140.A.16; -B.1.d; -D.1.d; 9 VAC 20-81-485.A.2). If a potential seep on the landfill slope is observed, the facility should assess whether the area may be cap drainage, a gas condensate leak, or a leachate seep. If the observed area is likely a leachate seep, steps should be taken as quickly as weather and soil conditions permit to eliminate the leachate seep and repair any cracked, eroded, or uneven areas of the cover.

Facility staff are required to *keep records* of inspections, and should document actions taken to manage and eliminate leachate seeps in a timely manner. Records may be incorporated into the Daily Log or Self-Inspection reports. (9 VAC 20-81-140.A.16)

Facility staff are required to *report* to the Department within 24 hours (orally) and 5 days (in writing) any noncompliance or unusual conditions that may endanger health or environment. Leachate seeps resulting in leachate outside the disposal unit boundary, leachate in a sediment basin, or an unauthorized discharge to surface water are considered unusual conditions requiring notification (9 VAC 20-81-530.C.3). Attachment 12 of the [DEQ Solid Waste Compliance Program Inspection Manual](#) further clarifies the 24-hr/5-day reporting requirements related to leachate control.

For closed landfills, post closure care requirements include maintaining the integrity and effectiveness of the final cover. (9 VAC 20-81-170.A.1.a) The Postclosure Care Plan specifies the frequency of inspections and maintenance activities. (9 VAC 20-81-170.A.2.a)

2. Requirement to Repair Leachate Seeps

The facility's Operations Manual or Post-Closure Care Plan for closed landfills should include methods to safely and effectively eliminate leachate seeps in accordance with standard industry practices. Actions to address and repair the leachate seep may vary depending on the source or cause of the leachate seep. Effective seep removal often requires excavating the area around the seep and through one or more layers of the waste mass (i.e. creating a chimney) to penetrate impermeable layers or remove impervious objects preventing leachate from percolating through the landfill.

Seep excavations generally cover small and/or shallow areas. Precautions should be taken to ensure that any large or deep excavations do not compromise the stability or integrity of the landfill slope. If the excavation is completed near the toe of the slope, the facility should ensure that the leachate collection system and liner system are not compromised during repairs. Due to weather conditions, it may not be feasible to eliminate the leachate seep right away; therefore, it may be necessary to construct a temporary containment basin or install a temporary tank to collect leachate and prevent it from reaching the stormwater system while the work is performed. Any odor or vector issues stemming from the open excavation should be addressed by the facility, and any leachate released and leachate-contaminated soil outside the disposal unit boundary shall be properly collected and disposed. Landfills in post-closure care should dispose of contaminated soil offsite at a permitted solid waste management facility.

After the cause of the seep has been addressed, the excavation may be left open for a short period of time to make sure that the leachate is draining back into the waste mass and leachate collection system. Seep excavations may be left open for up to 48 hours unless an extension request (due to weather or other reason) is approved by DEQ. Excavations may need to be closed sooner than 48 hours if odor or vector issues are observed. The excavation may then be backfilled with coarse drainage material, such as gravel or tire chips, to within one to three feet of the slope, capped with suitable impervious material, and appropriate repairs made to the cover. Additional corrective measures may also include minimizing

stormwater infiltration with a smaller working face, maintaining positive drainage on the slopes and in conveyance channels, waste lifts sloped to the outside, and improving compaction of daily and intermediate cover.

Persistent seeps or seeps occurring on a slope with a geomembrane cap may require measures beyond the scope of this discussion. The facility is responsible for determining how best to meet compliance standards and should consult with DEQ staff for any proposed repairs that may affect the landfill liner, leachate collection system, final cover system, or other infrastructure. DEQ staff may provide compliance assistance by discussing the performance standard(s) necessary to maintain or achieve compliance; however, they should not dictate to a facility how to repair a seep.

3. Compliance Inspections by DEQ Staff

Recording observations. The compliance inspector should bring any observed leachate seep to the attention of the facility management and document the location, extent, and characteristics of the leachate seep(s) in the compliance inspection report (CIR). Consider the following elements for inclusion in the report:

- Breakout location (e.g., phase or cell number; directional side; top of slope, mid-slope or toe). If possible, locate the seeps on a facility map and include as an attachment with the cover letter. Seep locations may also be described via proximity to nearby gas or groundwater wells, gas vents, stormwater conveyance structures, or other site features.
- Description, to include:
 - Type of cover (e.g., daily, intermediate, final, vegetated, earthen, geomembrane);
 - Color, soil staining, volume, flowing or not flowing, odors; and
 - Stressed vegetation; or vegetation that grows well due to presence of moisture.
- Extent of seep (e.g., does it stop before edge of liner, has it entered stormwater conveyance structures, or discharged to surface water, groundwater, wells, springs, or drinking water sources)
- Photographs of the seeps
- Weather conditions (current, recent, and/or forecast)

Runoff in ditches, conveyance channels, sediment traps, or onsite retention basins is not a surface water. In documenting observations, use the term “discharge” only if referring to a discharge to surface water or discharge that may reasonably be expected to enter surface water.

Review of Operating Record. The compliance inspector should review the facility’s self-inspection reports compiled since the last inspection to identify records of any previous or ongoing leachate seeps and actions taken by the facility. The facility’s records should reflect actual operational conditions onsite and be consistent with any information reported to the Department in accordance with the 24-hr/5-day reporting requirements under 9 VAC 20-81-530.C.3.

4. Classifying Alleged Non-Compliance

Leachate seeps observed during a compliance evaluation inspection may or may not be cited as an alleged violation, depending upon the extent of the seep and the facility's response to the seep. Alleged violations should primarily be based upon non-compliance with one or more of the specific conditions listed under 9 VAC 20-81-210.F and 9 VAC 20-81-140.A.6. The following guidelines are provided to promote consistency in classifying alleged non-compliance and selecting the appropriate compliance instrument to accompany the CIR. As referenced in the guidelines, the "potential to discharge" should be assessed based on the location, extent and migration of the seep, proximity to surface water, wells, springs, or drinking water sources, weather conditions, and facility actions.

In addition to the guidelines that follow, DEQ staff should consider whether facilities took precautions in advance of a storm as discussed in [Subsection B.5](#). Also, if a leachate seep is an indicator of a failure to meet other operational requirements, such as poor cover maintenance on slopes, lack of cover, or failing to maintain a leachate collection system as designed, then the CIR should also include an alleged violation citing non-compliance with the other applicable requirements and the corresponding compliance instrument should be adjusted based on guidance provided in the Solid Waste Inspection Manual.

General Comment

Leachate seep(s) observed on the slope of a landfill, which:

- Are not causing an odor, vector or health problem, AND
- Have not moved beyond the edge of the waste cell into a stormwater ditch, AND
- The facility takes corrective actions to eliminate the seep(s) as soon as possible (i.e., as soon as weather and soil conditions allow safe working conditions).

Severity Level I Alleged Violation

- Leachate seeps extending beyond the disposal unit boundary, including into a stormwater channel but without any potential or actual discharge to surface waters, wells, or other water sources; facility stops further migration, protects health and safety, eliminates the seep, and properly collects and disposes of leachate, OR
- Seep previously documented with a No Deficiency Letter, but timely corrective measures were not taken.

Severity Level II Alleged Violation

- Leachate has migrated beyond the disposal unit boundary into the stormwater management system (i.e., sediment basin) with a potential for discharge to surface waters, wells, or other water sources, OR
- Large number of leachate seeps (e.g. line or curtain of seeps closely spaced together over a short distance) extending beyond the disposal unit boundary, including into a stormwater channel but without any discharge to surface waters, wells, or other water sources; facility stops further migration, protects health and safety, eliminates the seep, and properly collects and disposes of leachate, OR
- Seep previously cited with a Deficiency Letter, but timely corrective measures were not taken, OR

- Leachate not properly collected and disposed (i.e., returned to lined disposal area or permitted leachate collection system).

Severity Level III Alleged Violation

- Any pollutant discharge to surface water (i.e., discharge from contaminated sediment basin to receiving stream, unauthorized off-site discharge of leachate), wells, or other water sources, OR
- Leachate seeps have compromised the integrity of the slope or caused slope failure, OR
- Seep previously cited with a Warning Letter, but timely corrective measures were not taken.

If a discharge of leachate to surface water has occurred, the NOV should cite alleged non-compliance with 9 VAC 20-81-140.A.6 and 9 VAC 20-81-210.F as applicable. In addition, the NOV should cite the State Water Control Law, §62.1-44.5

5. Best Management Practices in Advance of Storm Events

In accordance with 9 VAC 20-81-130.H., the runoff control system from the active portion of the landfill must be designed to collect and control at least the water volume resulting from a 24-hour, 25-year storm, and not cause any discharge of pollutants to state waters in violation of the Clean Water Act and VPDES requirements.

A “24-hour, 25-year storm” refers to a rainfall event with a 1 in 25 probability, or 4 percent chance, of occurring in any given year. Site-specific rainfall precipitation frequency data corresponding to 25-year storm events can be obtained from the U.S. National Oceanic and Atmospheric Administration (NOAA) Atlas 14. Partial duration time series shall be used for the precipitation data in accordance with 9 VAC 25-870-72.

The following are examples of appropriate preparatory actions a facility may take prior to a foreseeable storm event:

- Inspection and assessment of leachate storage structures;
- Maintaining an extra inventory of chemicals for treatment and discharge systems;
- Reinforcement of potential weak points in stormwater diversion berms or impoundments;
- Clearing stormwater conveyance channels of sediment, woody vegetation, and debris that could prevent the channel from functioning as designed;
- Draw down, treatment, and disposal of stored leachate in accordance with the facility’s permit in order to provide sufficient freeboard in leachate storage unit;
- Contacting leachate haulers prior to the event to stand by to draw down leachate tanks or leachate ponds during or immediately following the storm event for pump and haul;
- Alternate power source for leachate pumping station or pumps in the event of power failure;
- Temporary suspension of leachate recirculation; and
- Other facility-specific measures.

6. Characteristics and testing of leachate

When water percolates through solid waste, both soluble and insoluble constituents separate from the decomposing waste. Leachate is typically dark in color and may have an odor. The characteristics of the leachate produced by a landfill are highly variable, depending on many interacting factors such as the composition and depth of waste, the availability of moisture and oxygen, landfill design and operation, and waste age. Leachate may contain some chemicals (i.e., high salt concentrations) that are not necessarily toxic or hazardous, but could impact groundwater, surface water, wells, or other water sources if discharged. Leachate may also contain heavy metals such as lead or arsenic, and organic pollutants such as polychlorinated biphenyls (PCBs).

The facility may need to sample a seep to characterize and demonstrate the presence or absence of leachate. If a seep is tested, the facility should review the data and note date and results of laboratory tests. Consistent with [Guidance Memo 2016-02: Permitting, Sampling, Analysis and Data Reporting associated with Solid Waste Underdrain Systems](#), appropriate indicator tests for leachate include chloride, alkalinity, total suspended solids (TSS), total Kjeldahl nitrogen (TKN), biochemical oxygen demand (BOD), and chemical oxygen demand (COD). Typical ranges of concentrations for some of these parameters are listed in the table below. Keep in mind that leachate composition varies significantly, especially as the landfill stabilizes and parameter concentrations decrease, and may be outside the typical range presented. For leachate that has released to stormwater, surface water, or other water sources, constituent levels may be outside the ranges provided due to dilution. In these instances, a sample of the seep should be collected as close to the source of the seep to confirm/deny the release of leachate. In addition, other parameters may be appropriate for analysis based on landfill wastes accepted. If site-specific leachate analytical data is available or a current leachate sample can be obtained and analyzed, then that data should be used for comparison.

Indicator Tests to Characterize Leachate

Constituent	Typical Range*
pH, field (pH units)	4.5 – 9.0 ¹
Conductivity, field (µS/cm)	250-3500 ²
BOD (biochemical oxygen demand)	20-57,000 ¹
COD (chemical oxygen demand)	140-152,000 ¹
TOC (total organic carbon)	30-29,000 ¹
Total Suspended Solids	50-150 ³
Ammonia nitrogen	50-2,200 ¹
Sulfate	8-7,750 ¹
Chloride	150-4500 ¹
Iron	3-5,500 ¹

* Units are milligrams per liter, except pH and conductivity as indicated

¹Source: [Kjeldsen et al. "Present and Long-Term Composition of MSW Landfill Leachate: A Review." *Critical Reviews in Environmental Science and Technology*, 32\(4\) \(2002\): 297-336. Web.](#)

²Source: [Haarstad and Maehlum. "Electrical Conductivity and Chloride Reduction in Leachate Treatment Systems." *Journal of Environmental Engineering*, 133\(6\) \(2007\). Web.](#)

³Source: Torrens, Kevin. (2018). *Leachate Quality and Disposal Considerations*.

To ensure that analytical results provide a valid representation of the sample tested, consideration must be given to sample collection techniques (e.g. grab vs. composite), the container(s) in which a sample is collected, preservation and shipment procedures, holding times, and chain of custody documentation. Guidance as to appropriate sample containers and handling may be obtained from the analytical laboratory. EPA guidelines for test procedures, containers, preservations techniques, and holding times are found in 40CFR136.3.

C. Surge Capacity in Impoundments & Tanks

In accordance with 9 VAC 20-81-210.B., tanks and surface impoundments used for storage of leachate shall have a flow equalization and surge capacity at least equal to the maximum expected production of leachate for any seven-day period for the life of the facility. Leachate storage capacity does not consider leachate that may have collected in or on the liner system.

It is in the best interest of the facility to keep leachate storage levels low to ensure surge capacity exists to protect human health and the environment (i.e. prevent leachate releases or discharges). Facilities may find it helpful to install a visual marker on the tank or in the impoundment or use automatic sensors/valves to ensure surge capacity is available and releases or discharges of leachate are prevented.

If high leachate levels are observed in the storage unit during the compliance inspection, inspectors should discuss with the facility the potential cause of the high levels and remedy to return levels to restore surge capacity. Initial and recurring instances of high leachate in storage units, as a result of a precipitation event or facility operations, with no evidence of leachate release from the unit should be addressed as a general comment in the CIR. The inspector should stress the importance of preventing releases/discharges and remind the facility to dispose of leachate and restore surge capacity.

Observed evidence or facility reporting of a leachate release from the leachate tank or impoundment without a release to surface water is a Severity Level II alleged violation. If the release reaches surface water, the incident is a Severity Level III alleged violation. Other considerations for determining the severity level include whether the condition is the initial instance versus a recurring instance, the extent of the release, and the facility's response to the release.

D. Leachate Recordkeeping

In addition to the recordkeeping mentioned throughout this guidance, this subsection focuses on the template permit condition, which states that permittees shall maintain "Documentation of the authorization to discharge leachate into the publicly/privately owned treatment works (POTW), leachate volumes sent to the POTW, and periodic leachate sampling analytical results." This permit condition is typically located in Module I, Section C of a full solid waste permit.

1. Discharge Authorization

The permittee shall maintain a copy of their authorization to discharge leachate. Authorization may be an approval letter from the POTW, contract with the POTW, VPDES permit, or other similar documentation to ensure there is an outlet for the expected quantity of leachate

generated. When constructing a new landfill cell or phase, an additional authorization may be requested by the Department to account for the additional quantity of leachate anticipated in order to obtain a certificate-to-operate.

2. Leachate Volumes

To satisfy this part of the condition, the facility should record leachate volumes sent to the POTW or approved treatment and/or disposal facility at a regular frequency (daily, weekly, monthly, or per discharge). When determining an appropriate recordkeeping frequency, pump & haul volume should be recorded each truckload. Facilities with continual direct discharge should have a flow meter recording volumes discharged and tabulate data daily, weekly, and monthly. If discharge is not continuous, then flows should be recorded per discharge. These records should meet the requirements of 9 VAC 20-81-530. Facilities with gravity discharge systems and/or without flow meters should consider adding a device to record discharge volumes.

Recording these volumes is important and allows the facility to monitor trends in the data. Increases or decreases in volumes can signal operational issues such as poor daily, intermediate, or final cover performance, pump failures, leachate line blockages, or unidentified releases. The data is also especially important as landfills move into post-closure care and seek post-closure care termination. In accordance with [Guidance Memo 01-2007: Post-Closure Care Termination](#) and [Submission Instruction No. 20: Termination of Post-Closure Activity Evaluation](#), data on leachate generation rates and analytical data as discussed in Section V.D.3. below, are essential in determining whether leachate management can be discontinued.

3. Leachate Sampling Analytical Results

The permit condition requires facilities to maintain documentation of periodic leachate sampling analytical results without specifying the sampling and analysis to occur. However, it is a standard practice for the receiving POTW to either perform sampling and analysis on industrial waste streams, such as leachate, or to require that the facility sample, analyze, and possibly pretreat leachate as part of a discharge permit issued by the POTW. The constituent analysis would be POTW-specific, though standard parameters include Biological Oxygen Demand (BOD), Total Suspended Solids (TSS), Nutrients (nitrogen and phosphorus), and pH. Depending on the POTW, sampling and analysis may also include metals, volatile organic compounds (VOCs), semi-VOCs, pesticides, PCBs, hydrogen sulfide (H₂S), cyanide, BTEX (benzene, toluene, ethylbenzene, and xylene), MEK (methyl ethyl ketone), or any other specific constituent that the POTW may be limited to in its discharge permit or have the potential to upset the treatment works. Additional leachate-specific constituents to consider for sampling and analysis are those parameters identified in [Guidance Memo 2016-02: Permitting, Sampling, Analysis and Data Reporting associated with Solid Waste Underdrain Systems](#), and include chloride, alkalinity, total Kjeldahl nitrogen (TKN), and chemical oxygen demand (COD).

Facilities should request and maintain such sampling and analysis records. If sampling and analysis is not currently performed or the records are not available, facilities are encouraged to sample their leachate on at least an annual basis and maintain those records per this permit condition. Regular sampling and analysis can provide information regarding:

- Maturation of the disposal unit;

- Suitability of alternate leachate management and disposal options;
- Evidence to confirm or refute the presence of leachate seeps/releases or groundwater detections; and
- Suitability of post-closure care termination based on trends observed in leachate constituents.

Facilities that dispose of leachate by pumping and hauling to the treatment works are often required to perform a hazardous waste determination on an annual basis. The permit condition typically requires that “Leachate will be analyzed and characterized in accordance with the Virginia Hazardous Waste Management Regulations (9VAC20-60) to determine if it is a characteristic hazardous waste.” Sampling for metals using the toxicity characteristic leaching procedure (TCLP) is standard for the hazardous waste determination.

VI. Collaboration Process

A Leachate Workgroup consisting of Regional Land Protection Managers, Solid Waste Permit Writers, Solid Waste Compliance Inspectors, and the Central Office Solid Waste Permitting and Compliance Coordinators was formed to examine recurring leachate issues discovered by compliance staff in the field. The task of the workgroup was to evaluate current agency guidance, regulations, and practices to provide a consistent framework for compliance, clear regulatory requirements, and consistency amongst regional offices. The group began discussions in August 2017, which resulted in the development of this guidance

Other DEQ Central Office and Regional staff were given opportunity to comment during development. Additionally, comments from interested parties were solicited.

VII. References

[Solid Waste Inspection Manual](#)

[Submission Instruction No. 7: Leachate Management Plan for Solid Waste Management Facilities](#)